Modern Greenhouse Heating

N. B.—For Dimensions and Prices of Brick Set Boilers see 3d page of cover.

Dimensions and Prices of the Furman Steam Heater.

NUMBER.	Style of Burner.	Diam. of Grate. Inches.	Number Large Circulating Tubes.	Number Smaller Circulating Tubes.	Number Extra Back Tubes.	Length Large Circulating Tubes. Inches.	Length Smaller Circulating Tubes. Inches.	Number Steam Outlets.	Size of Outlets. Inches.	Size Return Inlet. Inches.	Height over all. Inches.	Extreme Width Boiler—inches.	No. Square Ft. Direct Radiation Supplied.	No. Square Ft. Heating Surface in Boiler.	Weight of Boiler Complete—in lbs.	PRICE, Complete with Trimmings.
1	Magazine	16	12		3	26		2	1½	1	52	28	275	50	1300	**$160**
	Surface...	16	12	7	3	26	13	2	1½	1	52	28	325	60	1300	**175**
2	Magazine	20	14		3	26		2	2	1	54	32	400	70	1600	**200**
	Surface...	20	14	7	3	26	13	2	2	1	54	32	460	80	1600	**225**
3	Magazine	24	12	9	3	26	13	2	2½	2	52	37	540	90	1900	**250**
	Surface...	24	12	15	3	26	13	2	2½	2	52	37	585	100	1900	**262**
4	Magazine	24	12	9	3	32	19	2	2½	2	58	37	630	110	2200	**275**
	Surface...	24	12	15	3	32	19	2	2½	2	58	37	690	125	2200	**300**
5	Magazine	30	15	13	3	32	20	2	3	2	58	46	750	140	2700	**325**
	Surface...	30	15	19	3	32	20	2	3	2	58	46	825	155	2700	**337**
6	Magazine	30	15	13	3	38	26	2	3	2	64	46	1000	175	3000	**350**
	Surface...	30	15	19	3	38	26	2	3	2	64	46	1100	195	3000	**375**

All steam and return pipes in the cellar or basement should be properly covered.

The Trimmings on each Boiler include Steam Gauge, Water Column and Glass, Safety Valve, Diaphragm with automatic Damper regulator and attachments, two Gauge Cocks, three Blow-off Cocks, Shaker, Lever, Pokers and all necessary Fittings and Connections. For pamphlets and further information address,

To supersede all previous Lists.

JULY 1, 1888.

THE HERENDEEN MFG. CO., GENEVA, N. Y.

AN ESSAY

— ON —

GREENHOUSE HEATING

WITH COMPLETE

INSTRUCTIONS FOR STEAM PIPING.

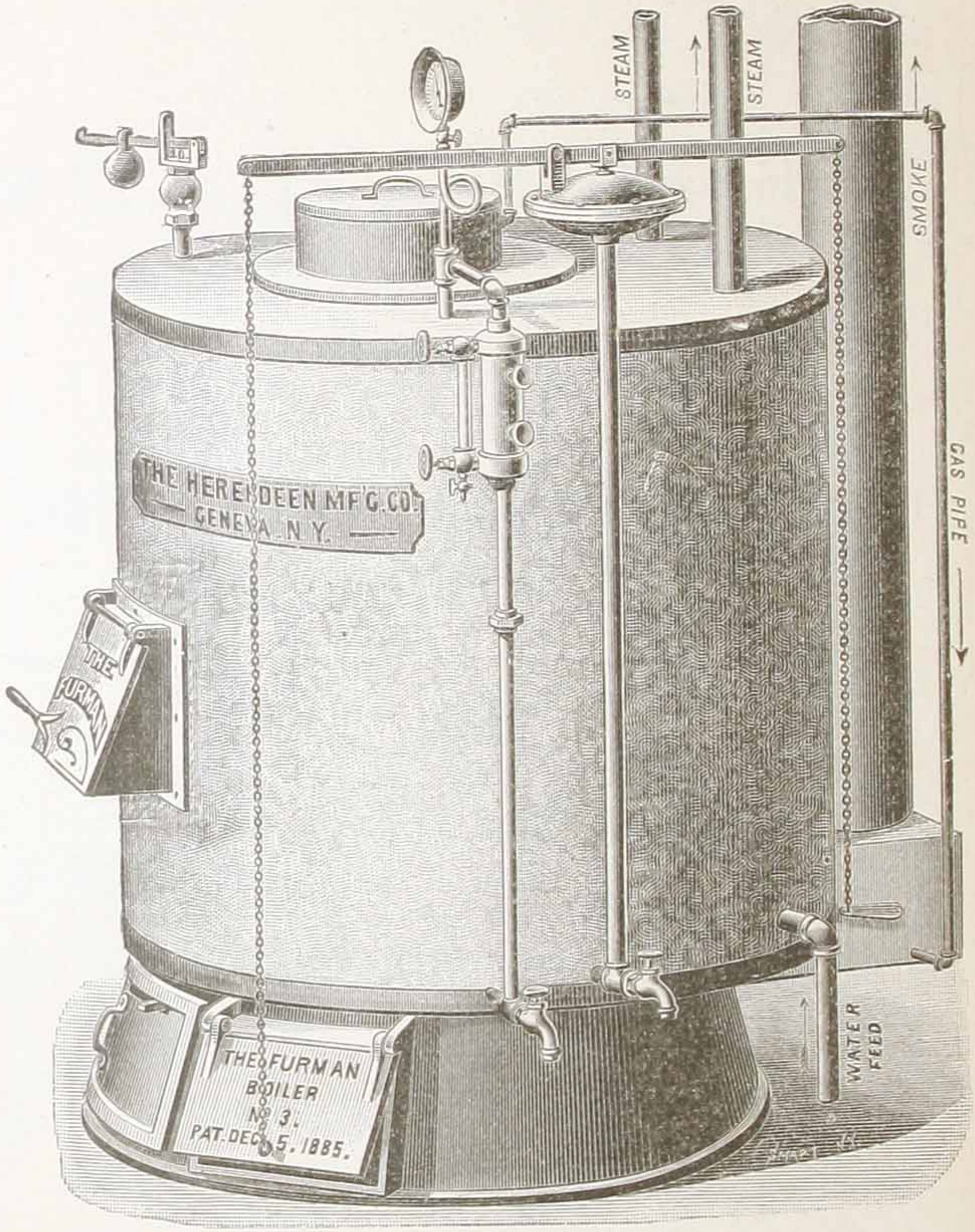
Together with a brief description of

The Furman Steam Boiler.

THE HERENDEEN MANUFACTURING CO.,

GENEVA, NEW YORK.

(c. 1888)



NO. 3 MAGAZINE BURNER.

STEAM HEAT FOR GREENHOUSES.

There is probably no question of more vital interest to Florists throughout the country, than that of the best, cheapest, and most practical method of warming Greenhouses.

The old system of heating by flues is now generally abandoned and to quite a large extent the use of hot water has taken its place.

Of late years, however, careful tests and comparisons made by some of the leading Florists in the country, (among them Peter Henderson, of New York,) have established the facts that in the use of steam over hot water

1st. A saving of 25 to 33⅓ per cent. can be made in fuel.

2d. An equally uniform temperature can be maintained in the house and accompanied by

3d. Very much less attention and labor in running.

4th. A saving of one-third of the first cost of the apparatus can be made and nearly as much in the labor of putting in the systen.

How Can Fuel be Saved?

In the warming of Greenhouses the natural heat of the sun plays a very important part. By using steam, when the sun shines out strong and the temperature would otherwise rapidly run up, simply closing the valve instantly stops the throwing off of heat by the steam pipes, and in the best and most modern of self regulating steam generators, the production of steam and consumption of coal will be likewise instantly checked.

In a hot water system the pipes retain for a long time their heat after the fire has been shut down, because the pipes still remain full of hot water, consequently the temperature of the house runs up so fast as to necessitate opening the top ventilators and so cause a wastage of good heat.

Which System will Maintain the Most Uniform Temperature?

It has frequently been remarked that hot water is both "slow in receiving heat and slow in parting with it," and it is therefore impossible to regulate the temperature with any degree of satisfaction in sudden changes of weather.

Steam on the contrary responds quickly, either in producing warmth or in stopping its production and is therefore by far the best adapted for use wherever a constant and uniform temperature is desired.

Another reason. Steam pipes are invariably the same degree of warmth no matter how remote from the boiler. Hot water pipes on the contrary are liable if carelessly set to become much hotter the nearer they are to the boiler, and they will rapidly grow colder the more distant they are. Consequently all parts of the Greenhouse are not warmed equally, as the parts nearer the boiler receive the most heat.

Ease of Running.

The majority of Florists do not visit their houses from evening till the next morning, therefore it is of the utmost importance that the boiler be constructed to keep up a good fire and steam all night without attention.

In portable boilers we universally recommend our magazine burner for greenhouse use, as by once filling the magazine at night with coal it will keep up steam in the coldest weather eight to ten hours without attention and therefore insures a warm house all night as well as day.

Saving on First Cost of the Apparatus.

This point, as well as others, is very fully discussed in our boiler catalogue for 1888, (see pages 25 to 28,) but the argument in brief is as follows:

Steam being much hotter gives off about one-third more heat per foot of pipe than hot water, consequently much

smaller pipes will do the same work, or fewer feet of the same size pipe, and a saving of fully one-third can therefor be made in the first cost of the pipe and of course a corresponding amount in the labor of putting up the system.

These facts speak for themselves and may be verified by any one with little effort.

HOW TO PIPE FOR STEAM.

There are two distinct systems employed in piping houses for steam. One may be termed the "under bed" system, the other, the "over head" system.

For many reasons we prefer the latter of which the following is a brief description.

The boiler is set in a pit in one end of the house, (the lower end, if the house inclines a little,) so that the top of the steam dome will be below the level of the walks in the house.

The flow pipes from the boiler run directly upward perpendicularly to the peak of the house, then extend over head on a gradual down grade to the far end, then drop down one under each bed and return, still on a grade, to the boiler, where they bend down and enter the same for the return condensation. The whole idea being that all of the pipes exposed are above the water line of the boiler and thus become in other words a radiating surface for live steam.

It is noticed in this way the heat in the house will be about evenly divided, one-half (or a little more) being over head and the balance under the beds.

In the other system, or "under bed" system both flow and return pipes are under the beds, which is the only difference between the two. The points urged in favor of the former system are—

1st. It gives a more natural or sun like radiation downward upon the plants.

2d. It prevents the chilled air from the glass striking the plants and also very much hastens the melting of any snow which may be upon the roof, thus utilizing the sun's heat sooner.

3d. The pipes are easier put up, have a sharper descent for the flow of steam and water, and are in plain sight all the time.

Of course it is to be borne in mind that in a Propagating House this order of thing is to be reversed as all the heat is there desired to be underneath the beds for root growth.

In long houses however the flow pipes may be run overhead, care being taken to thoroughly cover and wind them to keep in the heat, the return pipes being run back under the beds in the ordinary way.

Work of putting in Steam.

The mechanical labor of piping a house for steam as outlined in the above directions is so simple that it is not necessary to hire a high priced steam fitter, as any man using a little common sense can readily do all the work required.

When desired we will supply pipe, fittings, tools, etc., at wholesale, so that a complete job can be put in at the least possible expense.

How much Pipe will be Required?

Steam heating is almost universally reckoned by superficial feet of radiating surface. A square foot being the standard.

The following table gives the actual length of different sized pipes sufficient to make 10 sq. ft. of radiation as above explained :

1	inch pipe	28	lineal ft.	=	10	sq. ft. radiation.
1¼	"	"	24	"	=	" "
1½	"	"	20	"	=	" "
2	"	"	16	"	=	" "
2½	"	"	13	"	=	" "
3	"	"	11	"	=	" "

Careful and repeated tests made by well known Florists

and Steam Engineers in different parts of the country have established the following proportions for amount of radiating surface as compared with glass surface :

For Different Latitudes.

(*a.*) For the latitude of Canada, Northern New York, New Hampshire, Vermont and Maine use one sq. ft. of radiating pipe surface to 3½ to 4 sq. ft. of glass.

(*b.*) For the Middle States and balance of New England States use one sq. ft. of radiating pipe surface to 4 to 5 ft. of glass.

(*c.*) For Philadelphia and similar latitude use one sq. ft. of radiating pipe surface to 5 to 6 ft. of glass.

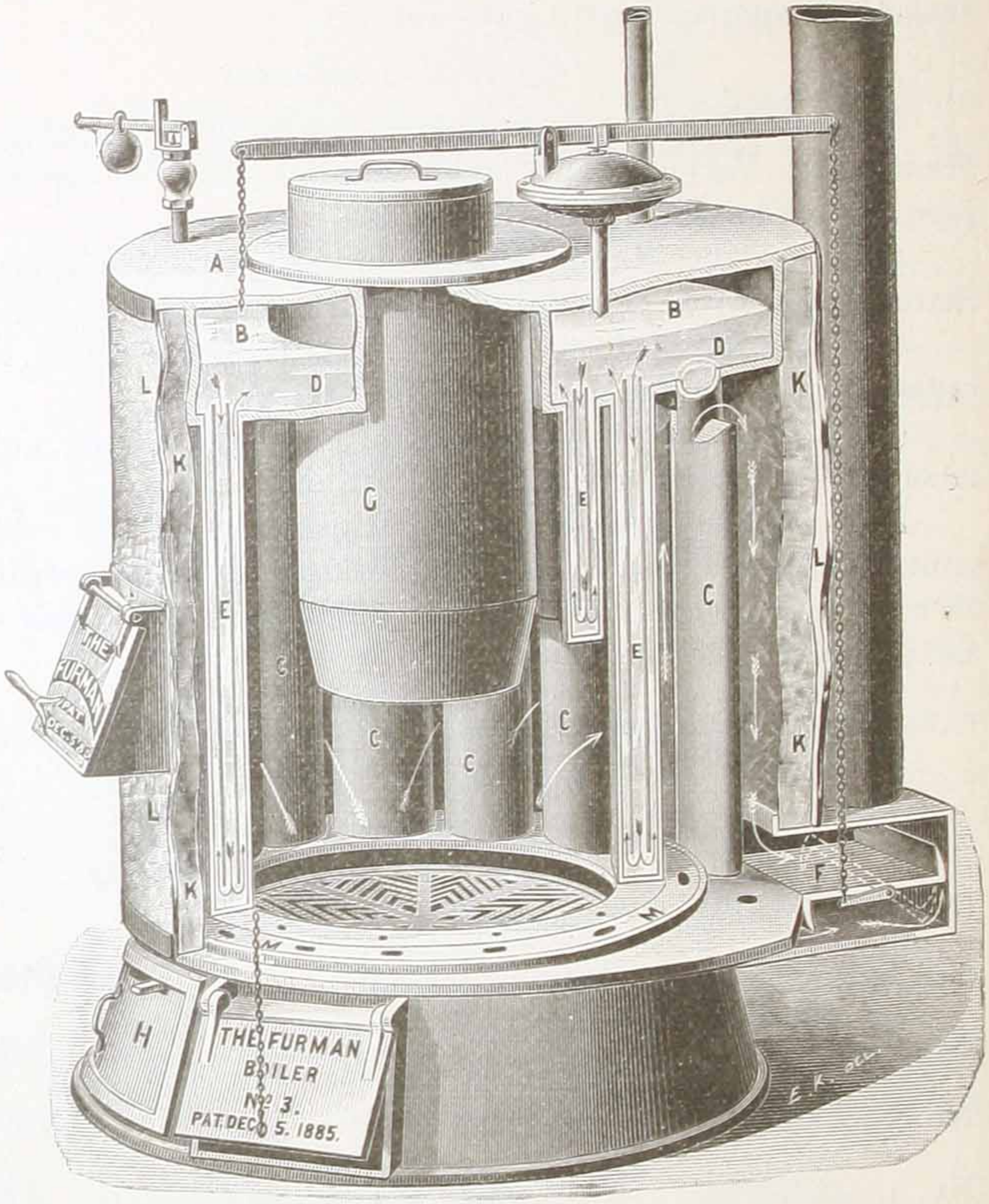
(*d.*) For Baltimore, Washington and the South use one sq. ft. of radiating pipe surface to 6 to 8 ft. of glass.

This will be found to give a temperature in the coldest winter weather of 50°. Florists desiring a higher temperature for exotic plants can add to their piping a sufficient proportionate amount.

TABLE OF THE APPROXIMATE AMOUNT OF GLASS SURFACE WHICH EACH SIZE BOILER WILL TAKE CARE OF.

Magazine Burner.	Lat. *a.*	Lat. *b.*	Lat. *c.*	Lat. *d.*	Sq. Ft. Radia'n Supply.	Price.
No. 1.....	1000	1200	1500	2000	275	**$160**
No. 2.....	1500	1800	2200	2700	400	**200**
No. 3.....	2000	2400	3000	3700	540	**250**
No. 4.....	2400	2800	3400	4400	630	**275**
No. 5.....	2800	3400	4100	5200	750	**325**
No. 6.....	3800	4500	5500	7000	1000	**350**

Prices of our larger boilers made known on application.



NO. 3 MAGAZINE BURNER—SECTIONAL VIEW.

DESCRIPTION.

A Steam and Water Dome.

B Steam Space.

C Circulating Tubes.

D Water Space in Dome.

E Inside Division or Diaphragm.

F Automatic Damper.

G Coal Magazine.

H Sliding Door to Remove Ashes.

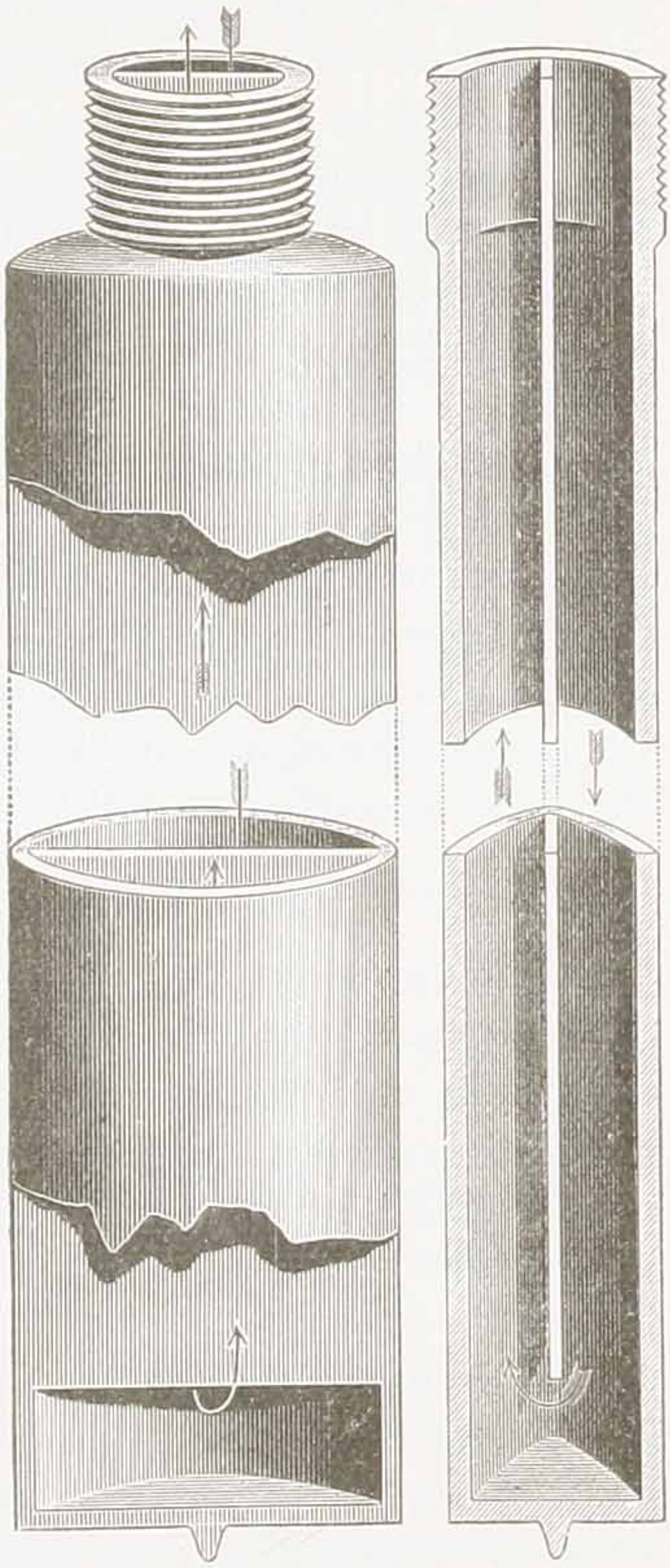
K Asbestos Lining, Air Space and Inside Jacket.

L Galvanized Iron Jacket.

M Sliding Dust Ring for Cleaning out the Ashes and Soot.

White arrows show direction of heat and draft.

Black arrows show circulation of water in the tubes.



SHOWING THE CIRCULATION OF WATER AND STEAM.

A Brief Description of the Furman.

The Furman is made entirely of cast iron, but from its peculiar construction cannot be affected by any variation of temperature and consequent expansion or contraction, however sudden or severe.

The steam is generated in a row or series of elliptical shaped tubes which entirely encircle the fire from grate to steam dome. These tubes are closed at the bottom and open at their upper ends which screw up into the steam-dome above. This dome is made of one casting and is filled the lower half with water, the upper half with steam, when the boiler is running.

The tubes each have a division or diaphragm extending through from the top to within two inches of the bottom. This division passes through the long axis of the tube; and the circulation of the steam and water is thus thoroughly provided for, the steam ascending on the inside division next the fire and the water descending on the outside division to take its place.

Action of the Fire.

The fire box of the Furman is slit perpendicularly by the distance apart between each tube, or about one-half inch. All the smoke and hot gases and flames are thus forced out between the tubes laterally. This causes the intense heat of the center of the fire to pass through the coals around the edge and consequently they are kept bright and in a state of perfect combustion.

The universal difficulty heretofore experienced with water leg boilers is, that the water cools down the coals next the edge of the fire below the point where combustion can take place, thus losing a large proportion of the active fire surface of the boiler. This radical difference in the Furman is worth more than a passing thought.

The smoke and products of combustion after passing out between the circle of tubes, travel around to the rear, then pass

over the shoulders of the three large extra back tubes, and then drop to the bottom and escape into the smoke pipe.

Perfect combustion takes place and all the available heat generated by the fire is literally absorbed by the water and turned into steam.

In minor points, the boiler is fully equipped with complete self regulating dampers, anti-clinker grate, lever shaking, dust ring for falling soot and ashes behind the tubes, etc., sixteen sizes. Compact, no gas dust or smoke, no flues to choke up, sectional, set in any six foot cellar, no packed points, burns any kind of coal and guaranteed economical in fuel.

The first twelve sizes are portable, the boiler being incased in easily removable jackets. The larger sizes are to be set in brickwork.

We manufacture in two styles, for center feed magazine burners, also for surface burners, but on our ordinary portable boilers we always recommend the magazine style of burner for Greenhouse purposes.

Send for full illustrated book on steam heating, mailed free on application.

Large Boilers.

In the construction of boilers, of large capacity, boilers capable of heating from 5,000 to 10,000 ft. of glass, it has been found that the large steam domes were exceedingly hard to cast, adding very materially to the cost of manufacture, while from their great size, they were very difficult to handle, and liable to injury—in short, impracticable in every way.

We have overcome this obstacle by joining together a series of smaller rectangular domes, placed side by side, in any number, so that we can produce a boiler of any required capacity sufficient to carry from 1800 to 3000 or more square feet of radiation.

These domes are 14 in. wide, by 4 or 5 ft. long and can be connected together, as many as desired.

They have the same system of upright circulating tubes which are found in our portable boilers, and combine all the scientific features of their arrangement and construction which have been found to give them such a high degree of effectiveness and steam producing qualities.

These boilers are to be surrounded by a brick wall or arch, which being rectangular in shape is easily made by any mason. As we save some portions of the boiler, such as the jackets, we are enabled to sell them at the same price per foot of radiation that we do the portable boilers and allow the cost of the brick work to be charged back ; so that the boiler will not cost the customer, set, any more per foot of radiation than a portable boiler. We provide the same system of shaking dust rings that are found in the portable boilers, for removing ashes which may pass through the slots between the tubes. In addition we place at each of the four corners of the brick setting a door by means of which the whole exterior of the boiler may be easily swept and cleaned at pleasure without removing or disturbing the boiler in the least. Through the door by which the boiler is supplied with fuel the interior of the boiler may be cleaned without any trouble ; thus both sides of the boiler are placed in the control of the operator for cleaning purposes without disturbing the brick-work or the taking down of any part.

The various domes are all connected into one common dome from which the steam is taken for supply mains. The water of condensation is distributed to each of the domes through a pipe at the outside of the brick-work, which maintains an accurate level of water in all. In this form of boiler we provide two rows of back tubes exterior to the tubes forming the fire box, instead of one row of tubes as shown in the portable boilers, over which the products of combustion are

passed and which effectually exhausts all the available heat from the fire.

Suspended from the domes all over the top of the fire hang numerous tubes substantially as shown in our surface burning boilers. The fire surface is thus made large and ample and the mo-t active fire upon the grate is completely taken care of, and its heat entirely absorbed by the adjacent water.

We make this form of boiler for surface burning only, as there is no difficulty whatever in placing sufficient coal in it at night to carry steam until morning.

The principal points that we urge for this class of boilers for large work, are as follows :

1st. A boiler of any size desired can be made without increased proportionate expense.

2d. The boiler is not liable to accidental injury as would be the case in a boiler having large domes and castings.

3d. All the scientific features embraced in our portable boiler in the most minute detail are copied in this.

4th. The brick set arch is a perfect protection against radiation and consequent loss of heat and does not cost the user anything additional.

5th. Means for perfectly cleaning the boiler are provided so that it may at all times be cleaned without deranging or tearing down any portion.

Send for our illustrated book on steam heating, if you have not already got a copy. Mailed free on application.

From W. W. GREENE, SON & SAYLES,
Florists,
Watertown, N. Y., May 2, 1888.

GENTLEMEN :—

Last winter we put on the boiler its full capacity, 5000 ft., and found it would carry steam ten hours at a time without attention *in zero weather*, but it had to be crowded when the mercury dropped to 25° below. Next winter we shall run it on only 4000 ft. of glass, which it will handle perfectly. The size is a No. 6 Magazine Burner.

Yours truly,

W. W. GREENE, SON & SAYLES.

WHAT PROMINENT FLORISTS SAY.

From PETER HENDERSON,
Florist and Seedsman.

New York, May 25, '88.

HERENDEEN MFG. CO., GENEVA, N. Y.

Gentlemen:

In reply to your question asking for my experience in the use of steam over hot water for greenhouse heating, I would state that on repeated trials made during the winter of 1885 on two similar houses, each 20 ft. x 350 ft. equally exposed, one heated entirely by steam and the other heated entirely by hot water it was found that *25 per cent. was saved in fuel* in the house heated by steam over the hot water house.

This fact I made public in August. '86, before the meeting of American Florists in Philadelphia. Yours very truly,

PETER HENDERSON.

Office of W. W. GREENE, SON & SAYLES,
Florists,

Watertown, N. Y., Apr. 20, '88.

HERENDEEN MFG. CO.,

Gentlemen:

We have always heretofore used hot water for heating our greenhouses. Last summer we became convinced that steam was better and cheaper. We took a trip to Oswego, Syracuse, Utica, Auburn and Geneva, looking up and examining the different boilers made in those towns. We ordered two of your No. 6. Mag. boilers and after a winter's experience wish to state that they have been perfectly satisfactory every way. We have been making some careful tests to determine whether steam or hot water used the most coal. (Some of our houses are still heated by hot water).

During 24 hours when the mercury stood 14° below zero we burned 400 lbs. of coal in hot water boiler taking care of 1,000 feet glass surface, and 800 lbs. coal in steam boiler taking care of 3,000 feet of glass, *thus saving one-third the coal and one-half the labor.*

You may send us one of your No. 7. brick set boilers any time after August 1st, next, which we shall put in to displace the remainder of our hot water Boilers.

Our experience is, once use steam and you will have nothing else.

Very truly yours,

W. W. GREEN, SON & SAYLES.

"WALNUT HILL."

Geneva, N. Y., April 18, '87.

THE HERENDEEN MF'G CO.,

Gentlemen:

It gives me pleasure to state that the two No. 2 boilers placed in my Greenhouses last October have given in every respect entire satisfaction.

They have kept the houses perfectly warm in the coldest weather we have had, maintaining a very even temperature, which as everyone knows is of the utmost importance in Greenhouse heating.

My florist, Mr. Burns, can tell you more exactly how much coal we use, but I know that during the most severe zero weather experienced, we have kept up a uniform temperature of 70 degrees, burning at the same time only about *200 lbs. of coal* in each boiler every 24 hours. In ordinary winter weather we can keep up the same temperature on half that amount of fuel.

The houses are each 25x50 ft. floor space, 16 ft. high at the ridge, and five feet at the eaves, with arched roofs. Both of them therefore contain about 28,000 cubic ft. of space, and we carry from both boilers a radiating pipe surface of about 500 sq. ft.

Connecting the boilers together is also an excellent idea, as in the early fall and spring months when we only want a little heat comparatively, we only run one boiler, firing up the other when it becomes necessary.

Taken all together, the size of our houses, amount of coal we burn, and the uniform temperature which we maintain, also the simplicity and ease of running, I consider the "Furman" far ahead of any other heating apparatus, steam or hot water, I have ever seen, and I would especially recommend it for Greenhouse use.

Very truly yours,

WM. J. KING.

What Mr. King's Florist says.

Geneva, N. Y., March 19, '88.

THE HERENDEEN MFG. CO.,

Gentlemen:

Your boilers have worked just as well this winter as they did last.

I have kept a careful account of all the coal we have burned in both of them, and find that from Nov. 16, '87, when we first started up, till Jan. 26, '88, we used altogether just 13 tons, 400 lbs. We then got 11 tons more, and have enough now on hand to last till the first of April.

This makes only 12 tons burned in each boiler during the whole winter, which I consider a remarkably small amount. They are the easiest boilers to take care of I ever saw.

Yours respectfully,

LAWRENCE BURNS, Florist.

From GROVE P. RAWSON, Florist.

Elmira, N. Y., May 7, '88.

HERENDEEN MFG. CO., GENEVA, N. Y.

Gentlemen:

Steam is taking the place of hot water altogether in the large ranges

of forcing houses, for the reason that a higher degree of heat can be maintained in severe weather and at a less expense in fuel. In smaller greenhouse operations the boiler should be large enough to keep up steam for seven or eight hours. Mistakes are made in this respect, and whoever has had such an experience, does not take kindly to steam heating.

The fact that greenhouse men generally are using steam in preference to hot water speaks for itself.

Yours truly,

GROVE P. RAWSON.

From JAMES MORGAN,
Florist.

Auburn, N. Y., May 22, '88.

HERENDEEN MFG. CO., GENEVA, N. Y.

Gentlemen :

For some time now I have been using steam exclusively for warming my greenhouses, and I would state that I consider it in every way far superior to hot water.

Some of my houses are piped in the "overhead" system, and others in the "under bed", but I am convinced that I can get better results by piping "overhead" except for propagating purposes.

For size of pipe, I would recommend in ordinary houses 1¼ or 1½ in. These come cheaper than the larger sizes, while they give excellent heating results.

I have just completed a large new house, which will require two of your No. 3. Magazine boilers.

My experience is that two smaller boilers are preferable to one large one, as they can be run more economically in mild weather, by using only one small fire. Yours truly,

JAMES MORGAN.

From ADOLPH FROST, Florist,
Cortland, N. Y., Apr. 22, '88.

HERENDEEN MFG. CO., GENEVA, N. Y.

Gentlemen :

In reply to your inquiries I must say that in my opinion steam heating is far ahead of hot water or hot air, as I have used all. I now use steam altogeter. I had no trouble the past winter to heat my houses, containing over 5,000 sq. ft. of glass, from 50° to 60° at night. I think steam is more economical in fuel, heats quicker, and in fact is easier to handle when acquainted with. The main point in steam heating for greenhouses is to have the pipes high and dry, or at least two feet above the water line in boiler. Had bad experience in piping my greenhouse, the plumber did not know his business and put the pipes about even with water line in boiler which filled the pipes with water. Had to use from eight to ten lbs. of steam to force the water out and back into the boiler. That took too much fuel. Last summer I put some of those pipes high up, and used last winter about four lbs. of steam which kept my houses from 50° to 60° at night.

Yours very truly,

ADOLPH FROST.

NUMBER.	Style of Burner.	Size of Grate.	Number Large Circulating Tubes.	Number Smaller Circulating Tubes.	Number Extra Back Tubes.	Number Steam Outlets.	Size of Outlets--in.	Size of Return Inlets—in.	Height ft. in.	Width ft. in.	Length ft. in.	Sq. Feet Heating Surface.	Sq. Feet Direct Radiation Supplied.	Weight.	Number Brick Required.	PRICE, Complete with Trimmings.
7	Surface . . .	28x36	18	18	10	2	3	3	5.8	5.4	6	275	1500	4800	1800	$450
8	Surface . . .	36x42	22	26	10	2	3	3	5.8	5.4	7.2	364	2000	5400	2200	550